E-Journal Usage and Scholarly Communication using Transaction Log Analysis: A Case Study of E- Journal (Full Text) Download Patterns of NAL Scientists and Engineers

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Abstract

Most scientists today have access to full-text e-journals. In most cases, this facility is provided right at the desktop. In this paper, we present a case study of full-text e-journal patterns amongst the scientists and engineers at the National Aerospace Laboratories (NAL), a constituent of the Council of Scientific and Industrial Research (CSIR). The facility at NAL is provided right to the desktop through the NAL-CSIR-NISCAIR e-conglomerate. Today, National Institute of Science Communication and Information Research (NISCAIR) provides e-access to more than 4042 world-class e-journals to all S&T personnel of the CSIR fraternity. This CSIR-NISCAIR initiative allows any scientist in any CSIR Laboratory to access this electronic information to keep abreast of the latest technological developments in his area of specialization.

The analysis of data on the full-text e-journal patterns is presented for the period 2005 to 2007. The major findings that we would like to highlight in this paper are: (a) the mean number (per-month) of full-text downloads for the above three years was found to be different through Kruskal Wallis test of 'One Way Analysis of Variance' at 1% level of significance and (b) Chi-Square test was applied to test whether there is independence between the years and the publishers. The calculated value of Chi-Square was found to be 510.6, which is highly significant. Hence we conclude that for the full-text downloads data, the years and the publishers are not independent. This Chi-Square test was carried out for only those publishers (4 in number) for which the data was available for all the three years (2005-2007).

Keywords: Scholarly Communication, Usage Patterns, Scientific Communication, Electronic Journals, NAL, CSIR, NISCAIR

1. Science and Scientific Communication.

Science is undergoing some fundamental changes [1]. Much of science is experiencing greater specialization, while, on the other hand, some parts of big science is getting even bigger. Also, a great deal of research is becoming more multidisciplinary. This has led to collaboration among universities, government, industry all of which extend across national borders. Science education is becoming not only multidisciplinary, but also collaboratory, as more and more faculties teach across disciplines, departments and universities.

Learning is fundamental to science and communication is the heart of learning. Garvey [2], a psychologist at the Johns Hopkins University, summed up nearly two decades of scientific communication research by saying that

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"communication is the essence of science". 14 independent studies conducted from 1958 to 1998 observed that scientists spend a large, and perhaps increasing, proportion of their time communicating. Recent studies place this proportion in the range of 50 to 60 percent of scientist's time as spent communicating (on average).

Traditional scientific patterns have evolved into a multitude of channels, including data and image transmissions, informal discussions, e-mails/ messages, laboratory notes and technical reports, conference presentations and proceedings, journal articles, patents and books, to name a few. Each channel providing several distribution means and can involve a variety of media. All these channels of distribution result in a complex pattern of information flow.

Many studies conducted by the American Psychological Association (APA) for the National Science Foundation (NSF), during 1963-1968 and later in the 70's led many to believe that electronic technologies could minimize redundancies and produce more efficient communication capabilities.

2. Scholarly Journals: Scientific

The first two scientific scholarly journals were believed to have started at about the same time, in the mid 1600s [1]. One was the Le Journaldes Scavans, founded by M. de Sallo and the other was the Philosophical Transactions, a monthly journal of articles by the Royal Society of London to its members. In fact, Henry Oldenburg produced the first issue of a scientific journal, the Philosophical Transactions of the Royal Society of London, in 1665 [3]. By the end of the 17th century there were about 30 to 90 scientific and medical journals published worldwide and this number rose to about 750 by the end of the 18th century. Currently, there are about 80,000 to 100,000 scholarly journals published worldwide.

In an another study Okerson [4] reviewed the history of electronic journals and discussed a few examples from the early 1990s. She also counted the number of electronic journals listed in two directories from 1991 to 1999. The number of titles grew from 27 in 1991, to 3,634 in 1997, and to 8,000 in 1999.

Finally, questions about a journal's accessibility and readership can also hinge on the extent to which it allows readers free access to electronic versions.

3. The Electronic Journals

A large proportion of scientific scholarly journals are now available in electronic media. Most are digital replicas of traditional journals, with the majority provided in both paper-based and electronic media and a few are exclusively electronic journals. Much of the debate on the future of electronic publishing [3] concentrates on opportunities for readers, writers, and publishers. The accessibility of scholarly e-journals, their potentially lower production costs, the possibility of multimedia publication, and reference linking are treated as compelling features of the electronic medium that will enable them to thrive.

4. Information-Seeking and Reading Patterns: Their Trends

Evidence suggests that amount of reading and time spent reading have been relatively stable over the past 20 years, there have been some changes in the ways in which scientists identify the articles they read and there are appreciable differences in the sources of these articles. Surveys [1] from 1993 to

1998 show that scientists identify articles they read by browsing through journal issues or bound volumes. 62% of readings are identified in this way, by automated searches accounts for 12 %, by having other person tell them about the articles amounts to 11%, by using citations found in other articles, books etc. adds up to 9%, or by other means such as current awareness services, printed indexes, and so on fills the remaining 6%. The same study indicates that during the period 1993 to 1998, the scientists surveyed averaged about 120 readings of scholarly articles per year. In general, reading has shifted from personal subscriptions to library-provided journals, due in large part to a decline in the number of personal subscriptions and to better library services.

There are a number of factors that influence information-seeking and reading patterns [1]. Variation among Scientists' communication patterns is partially attributable to personal characteristics such as one's discipline, level of education and experience, and general communication capabilities. There are also situational factors as well, such as size of the organization, level of research funding, amount of funds available for information services, and availability and access to library services.

The authors in an interesting study opine that, scientists read at least one article from an average of 18 scholarly journals. However, they tend to read only a few of these journals extensively and most of them sparsely. For example, across all journals read by scientists only five percent of them are read more than 25 times by a scientist (on average) and about 80 percent are read less than 10 times. The amount of reading of a journal has a major bearing on whether it should be purchased, depending, of course, on the price compared with the cost of using alternative sources of the article. In the past, libraries have been the principal alternative to purchasing journals.

So, what do the various trends reflect? Since their birth in the 17th century, scientific scholarly journals have become the most type of publication and, for most fields of science, 'the most inevitable, and the single most important channel of communication' [1]. Over the last 40 years, numerous studies indicate that journals are extensively read; the information they contain is extremely useful for research, teaching and lifelong learning; and the information is valuable in terms of the favourable outcomes from its use.

5. Use and Users of Scholarly E-Journals: Transaction Log Analysis (TLA) Approach

Jamali, et al, [5], highlight the advantages and limitations of the log analysis approach. Even though there is a debate about the reliability of the results of the log analysis, this methodology has immense potential for studying online journal's use and their users' information seeking behaviour. It is a well understood fact that finding about the usage patterns of scholarly journals has been important for both the librarians and the publishers for a very long time. Interest of libraries in the use of journals is two-fold. First, research and academic libraries spend the biggest portion of their acquisition budget on serials. Secondly, virtually all academic and research libraries are moving towards electronic access to journals. In an environment like this, the users who have the world of knowledge at their fingertips are physically disappearing from the librarian's view. Therefore, understanding of the

usage of electronic journals, and the information seeking behaviour of users is of great importance both for libraries and publishers.

Before the advent of online journals [5], most of the studies on journal usage were based on (a) citation analysis, (b) re-shelving data or (c) questionnaires. All the three have their own limitations. Citation analysis does not represent all of journal usage as authors do not cite all the articles they read, and moreover, not every journal reader is an "author". Re-shelving data are not accurate. In this case, it is not possible to distinguish between the use of individual articles or the whole journal. It also does not use of personal subscriptions and the type of use. Questionnaire based studies rely heavily on what people think they do or might do – not what they actually do, and this could result in misinterpretations.

With the widespread use of computer and network technologies for facilitating access to scholarly journals, a new methodology has emerged for studying journal usage and scholarly information seeking behaviour. Computers record or log all user transactions in a plain text file known as a "transaction log". Log files contain data about many of the details of the users' interaction with the system. Hence, some researchers have adopted log analysis to find out about the use of electronic journals in terms of both the volume and patterns of use.

5.1. Transaction-Log Analysis Methodology Looked at in More Detail:

Let us first try to understand as to why the Web Server Transaction Log Analysis Methodology plays an important role in understanding the E-Journal full-text download patterns. Web server transaction log file analysis is a network-based assessment technique that is particularly useful when performed in conjunction with other ongoing activities [5]. Generally, the intent of the Web server log analysis is multi-purpose. Firstly, one can determine the overall Web site traffic including the location of users, the portions of the site accessed, and the number of document downloads. Second, one can determine the Web site directory traffic including the location of users, portions of the site accessed, and the number of document downloads (both hits and accesses). Thirdly, one can experiment with developing new log analysis techniques that go beyond domain, hit, and browser counts. Finally, one can assist government agencies to develop, implement, and maintain ongoing log file analysis.

5.2. Transaction Log Analysis Technique:

Web server log analysis technique generally involves a three-fold process that includes determining the types of information server administrator and decision makers need; developing a program that can parse through, manipulate, and present value-added information from the log files; and analyzing the information generated from the program. Web servers automatically generate four different log files: access logs (e.g. hits), agent log (e.g., browser, operating system), error log (e.g. download aborts), and referrer logs (e.g. referring links). These files are text files that can range in size from 1 KB to 100 MB, depending upon the traffic at a particular site. Distinction between a hit and an access is critical to understanding the type of data contained in these files. A hit is any file from a web site that a user downloads. Download of a Web page with 6 images on it accounts for 7 hits (6 images + 1 text page). An access (or a page hit) is an entire page download regardless of the number of

images, sounds, or movies on the page. Download of a web page with 6 images accounts for only one access.

6. Deep Log Analysis Method

Deep Log Analysis overcomes pitfalls of TLA. Nicholas [6, 7, 8] and his colleagues in CIBER conducted a series of studies on Emerald and Blackwell electronic journals in order to evaluate the impact of the Big Deal on users' behaviour and generally find out digital journal's users' information seeking behaviour. Based on the experience gained from investigating consumer health logs, they developed a more sophisticated methodology called Deep Log Analysis (DLA). Some of the salient features of DLA are:

- More attention is paid to the users in their analysis and the authors highlighted the importance of returnees and bouncers (calculating repeat visits of the users to the same site).
- The strength of DLA is due to the following features:
- Use of SPSS (statistical analysis package) to analyse raw logs instead of proprietary log analysis software. SPSS provides more flexibility and enables researchers to define their own variables and breakdowns.
- Enriching log data with demographic data, such as user data gathered from the subscription of publishers.
- Classifying users based through a combination of their demographic attributes and their usage.
- Paying special attention to returnees – users who come back to the use the service.

Three Deep Log Micro Analysis Techniques are [6]:

- The construction of a subgroup of users for which researchers can feel confident in regard to their geographical origin;
- The analysis of a subgroup of users for which users whose IP addresses were more likely to reflect the use of the same individuals; and
- The tracking and reporting of the use made by individuals rather than groups.

Deep Log Analysis methodology eventually provides a bigger, more accurate, and fuller picture than what is possible with standard survey techniques and provides some very powerful types of analyzes not obtainable from the standard log analyzing software [8].

6.1 Some Findings of Log Based Studies:

Log analysis has been applied for different purposes [5] such as assessing system performance, studying user's searching and browsing behaviours, investigating the effectiveness of Big Deal subscriptions, studying literature decay, etc. Digital journal platforms or libraries also have different features. These factors make it difficult to compare the results of the different studies and achieve and make generalizations. Nevertheless, there seems to be a considerable degree of concentration in the use of journals. According to [9], found that just 20 per cent of titles accounted for nearly 60 per cent of usage. According to [10], revealed that a small number of heavy users can have an extremely large effect on the number of total downloads. Another study [11], showed that 4.9 per cent of a journal collection satisfied 44 per cent of downloads and, on the other hand, 59 per

cent of the collection represented only 10 per cent of the use of the collection. The effect of log analysis limitations, particularly the problems with caching and proxy servers, on this asymmetric pattern of use is yet to be investigated. Log studies also indicate a relative preference for PDF versions of articles to HTML versions among users [12, 10, 6]. Questionnaire studies confirm this preference and highlight the fact that most users do not like reading on the screen [13, 14, 15]. This indicates that users of e-journals probably choose a PDF version because it is more printer friendly and better for archiving.

Log studies have been particularly helpful in understanding the searching and browsing the behaviour of e-journal's users. The findings of eJUST project showed that there were two major starting points for journal web visits, i.e. through journal home pages and through PubMed. Entering journal web sites through homepages usually led to either browsing contents or searching for an article. More users read full text right away instead of reading abstracts first to see if articles were of interest; however, certain journals' users requested abstracts before reading full text. Users tend to read full text after browsing contents. Either abstracts or full text views in HTML preceded requests for full text in PDF format. However, three very common seeking patterns were found:

- Journal homepage – TOC – HTML full text – PDF full text;
- PubMed – HTML full text – PDF full text; and
- journal homepge – search – HTML full text – PDF full text.

The findings showed that most requests were for full text in HTML, which were then followed by requesting the full text in PDF, as if the final goal of most visits was to take away a PDF version of an article. Also, the study revealed that library catalogues and bibliographic databases, which are both searching mechanisms, were the top two sources that led users to journals [16].

Although, there has been an ongoing debate on the pitfalls of web log analysis, some of the studies indicate that there is every opportunity for improving the methodology. DLA methods developed by Nicholas and his colleagues at CIBER have opened a new horizon in studying e-journal use and users. Several steps can be taken to enrich the log data and so obtain more robust data:

- for instance, who is a user, what is a hit, what represents success, etc.) re-align as necessary, and assess statistical significance.
- The raw data should be re-engineered to provide more powerful metrics and to ensure that data gathering is better aligned to organizational goals.
- Enrich the usage data by adding user demographic data (e.g. occupation, subject, specialism).
- Categorizing the users into smaller groups rather than looking at a broad picture of the usage and tracing the usage by some individual users as case studies help achieve a deeper knowledge of usage patterns and user's behaviour.
- Finally, to strengthen the results of log analysis and test the findings, some questionnaire, interview or observational studies should be conducted to explain the information seeking behaviour of the users discovered in the logs.

To sum up, log analysis is clearly useful for certain kinds of analyses, like shedding light on the format of the articles scientists read (PDF or HTML), the

age of the articles (obsolescence), and the way scientists navigate to the required material (searching and browsing behaviour). However, it is not at all helpful at discovering the value and use of the articles retrieved, or about what lies behind expressed information seeking behaviour. So far log analysis has not been a very efficient technique for finding out about the differences of information seeking behaviour among users from different subjects, or about the effects of the status of users on their information seeking behaviour. These are the areas in which log analysis methods must be improved. The results of log analysis should be enhanced by a triangulation of the findings of studies with other methodologies (e.g. employing a combination of log analysis, questionnaire surveys and observation studies).

7. National Aerospace Laboratories, Bangalore and its Scientists.

National Aerospace Laboratories (NAL) **[17]**, a constituent of the Council of Scientific and Industrial Research (CSIR), is India's pre-eminent civil R&D establishment in aeronautics and allied disciplines. NAL's primary objective, as articulated in its new Vision Statement, is the "development of aerospace technologies with a strong science content and with a view to their practical application to the design and construction of flight vehicles". NAL is also required "to use its aerospace technology base" for general industrial applications. NAL has a staff strength of about 1250 with about 400 full-fledged R&D professionals (over 100 Ph.D.'s). It is thus in a unique position to offer R&D support, expertise and services to both aerospace and non-aerospace sectors of industry. Scientists at NAL have been provided the unique facility of accessing almost 3316 international journals from about 11 international journal publishers by being part of the NAL-CSIR-NISCAIR E-Conglomerate right at their desktops.

8. CSIR, NISCAIR and the E-Journals Conglomerate.

The Council of Scientific & Industrial Research (CSIR) [18]—the premier industrial R&D organization in India was constituted in 1942 by a resolution of the then Central Legislative Assembly. Its Mission is to provide scientific industrial R&D that maximizes the economic, environmental and societal benefits for the people of India. Today it is one of the world's largest publicly funded R&D Organizations having linkages to academia, R&D Organizations and industry. CSIR's R&D portfolio embraces areas as diverse as Aerospace, Biotechnology, Chemicals...indeed, almost the ABC-Z of Indian Science.

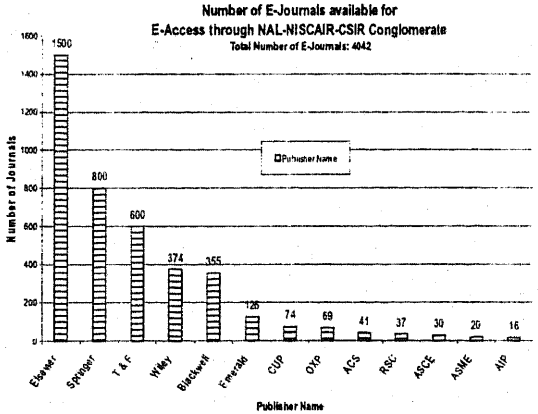
The National Institute of Science Communication and Information Resources (NISCAIR) is one of the constituent units of CSIR in the area of information science **[19]**. Its mission is to become the prime custodian of all information resources on current and traditional knowledge systems in science and technology in the country, and to promote communication in science to diverse constituents at all levels, using the most appropriate technologies. One of the main mandates of NISCAIR is to provide formal linkages of communication among the scientific community in the form of research journals in different areas of Science and Technology. NISCAIR aims to provide access to more than 4042 world-class e-journals to all S&T personnel of the CSIR fraternity from their desktops, through pooling and sharing of resources. Today, NISCAIR has tied up with 13 popular international publishers. The objectives of E-journals Consortia are: (a) to strengthen the pooling, sharing and electronically

accessing the CSIR library resources, (b) to provide access to world S&T literature to CSIR labs, (c) to nucleate the culture of electronic access resulting into evolution of digital libraries.

Till date CSIR has entered into agreement with 13 publishers to access about 4042 international journals across the labs. Details of the e-access is given below:

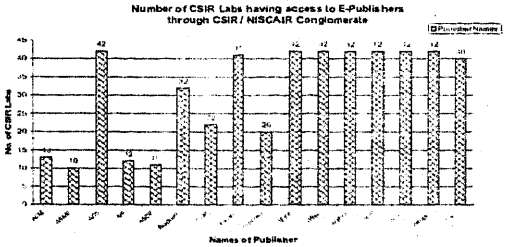
9. Some interesting findings of full-text e-journals download patterns of NAL Scientists from data available from NISCAIR Server:

Figure 1: Highlights the number of Scientific Journals available for E-Access through the CSIR-NISCAIR E-Conglomerate.



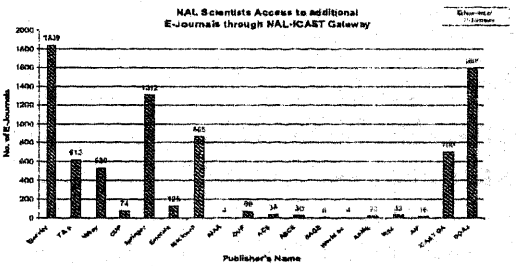
- The maximum number of e-journals for the conglomerate is from Elsevier, followed by Springer and T & F.
- Wiley and Blackwell e-journals are also available in good number.
- Journals from ASME and AIP are the lowest.
- There are 12 publishers whose e-journals are available for e-access for the conglomerate.

Figure -2: List of CSIR Labs Having Access to the following International Scientific Journal Publishers through the CSIR/NISCAIR E-Conglomerate.



- There are 42 CSIR labs which have access to 7 e-publishers from this conglomerate
- 41 CSIR labs have e-access to Elsevier and 40 labs having access to Taylor and Francis
- 11 CSIR labs have e-access to ASCE
- Only 10 CSIR labs have e-access to ASME

Figure -3: NAL Scientists access to additional E-Journals through NAL-ICAST Gateway



- NAL scientists have e-access to 1839 e-journals from Elsevier and 1600 e-journals from DOAJ and 1312 e-journals from Springer
- A moderate number of e-journals for e-access belong to Blackwell, Taylor and Francis and Wiley
- NAL scientists have open access to 700 e-journals through ICAST Gateway
- The minimum of e-journals for which e-access is available is for publishers AIAA and World Science.

Table – 1, 2, 3: Highlights the full-text usage statistics of E-Journals by NAL Scientists for the Years 2005, 2006, 2007.

Table-1: Year 2005

S.N.	Publ.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total-Publ. Wise
1	ACS	0	3	47	4	18	22	21	51	23	10	2	3	204
2	AIP	0	0	0	0	0	47	153	172	417	46	19	26	880
3	ASME	115	54	115	56	83	98	54	53	30	43	11	325	1037
4	CUP	12	15	31	47	16	12	22	2	8	0	6	13	184
5	Elsevier	1384	1026	2221	1056	1903	2000	1026	1914	1503	1120	1814	2100	19067
6	RSC	3	2	8	0	12	9	8	9	7	7	0	5	70
7	Springer	19	172	183	128	63	70	69	31	60	61	51	36	943
8	Wiley	28	67	147	158	123	129	144	348	117	133	84	153	1631
Total: (Month Wise All Publishers)		1561	1339	2752	1449	2218	2387	1497	2580	2165	1420	1987	2661	24016

ACS=American Chemical Society, AIP=American Institute of Physics, ASME= American Society of Mechanical Engineers, CUP=Cambridge University Press, RSC=Royal Society of Chemistry

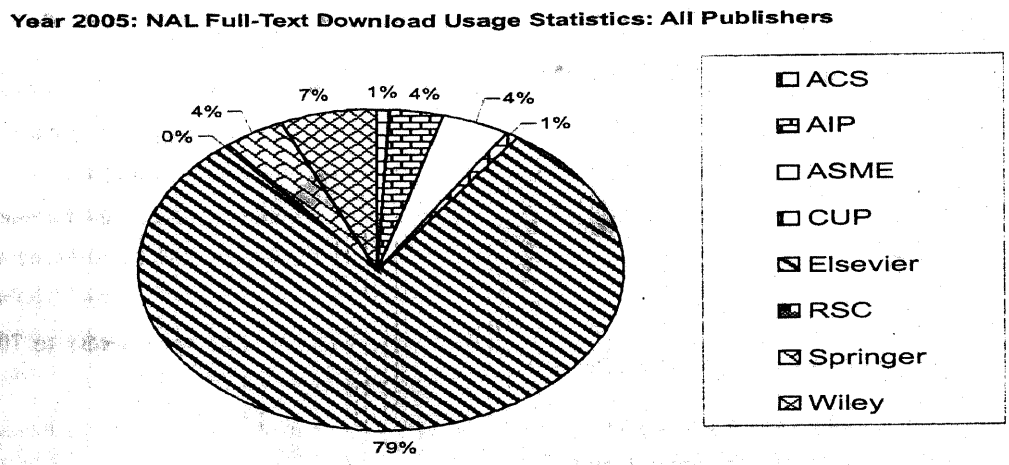


Figure – 4: Year 2005: NAL Full-Text Download Statistics: All Publishers

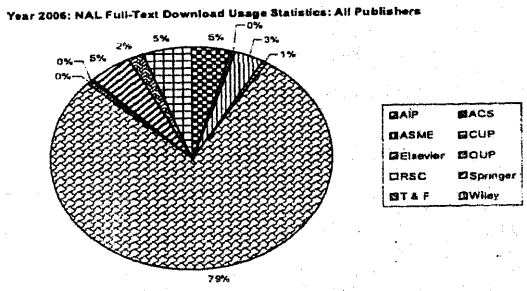
- 79% of full-text downloads for the Year 2005 is from journals published by Elsevier
- Only 7% of full-text downloads for the same year is from journals published by Wiley
- 4% each of full-text downloads are from publishers Springer, AIP and ASME
- Only 1% each of full-text downloads are from publishers ACS and CUP

Table-2: Year 2006

S.N.	Publ.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total-Publ. Wise
1	AIP	15	20	36	89	104	69	246	268	241	136	181	215	1620
2	ACS	1	8	7	3	5	12	2	10	8	19	13	40	128
3	ASME	0	39	67	40	63	50	103	66	177	83	397	112	1197
4	CUP	47	6	5	2	8	6	1	26	37	21	19	36	214
5	Elsevier	3202	3482	1888	2249	2837	1856	1698	2192	1512	2198	1939	2738	27791
6	OUP	0	0	0	0	5	6	12	6	38	53	29	0	149
7	RSC	1	1	3	10	7	4	3	5	6	15	16	21	92
8	Springer	137	100	90	98	98	81	63	175	314	93	313	283	1845
8	T&F	6	194	28	19	34	25	13	34	44	24	114	56	591
9	Wiley	216	91	124	120	210	201	119	161	172	131	237	174	1956
Total: (Month Wise All Publishers)		1561	1339	2752	1449	2218	2387	1497	2580	2165	1420	1987	2661	35583

ACS=American Chemical Societ, AIP=American Institute of Physics, ASME= American Society of Mechanical Engineers, CUP=Cambridge University Press, RSC=Royal Society of Chemistry,

T & F= Taylor and Francis, OUP=Oxford University Press



- 79% of full-text downloads for the Year 2006 is from journals published by Elsevier
- 5% each of full-text downloads are from publishers Springer, Wiley and AIP
- 3% of full-text downloads are from publisher ASME

Figure – 5: Year 2006: NAL Full-Text Download Usage Statistics: All Publishers

Table-3: Year 2007

S.N.	Publ.	Jan	Feb	March	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total-Publr.Wise
1	AIP	-	-	-	-	-	-	-	-	-	-	-	-	—
2	ACS	-	-	-	-	-	-	-	-	-	-	-	-	—
3	ASME	-	-	-	-	-	-	-	-	-	-	-	-	—
4	CUP	-	-	-	-	-	-	-	-	-	-	-	-	—
5	T&F	-	-	-	-	-	-	-	-	-	-	-	-	—
6	Elsevier	4006	3453	5759	5105	4396	4302	4333	5653	4103	4645	3689	3335	52779
7	RSC	44	24	34	56	62	42	48	24	44	94	26	18	516
8	Springer	349	323	268	426	346	409	465	442	410	465	317	395	4615
9	Wiley	322	322	452	406	786	444	456	418	322	362	406	232	4928
10	ASCE	8	6	16	20	18	52	20	6	16	20	0	0	182
Total: (Month Wise All Publishers)		4729	4128	6529	6013	5608	5249	5322	6543	4895	5586	4438	3980	63020

ACS=American Chemical Societ, AIP=American Institute of Physics, ASME= American Society of Mechanical Engineers, CUP=Cambridge University Press, RSC=Royal Society of Chemistry, T & F= Taylor and Francis, ASCE=American Society of Civil Engineers. Download statistics of ACS, AIP, ASME, CUP have not been tabulated for 2007 because of non-availability of data.

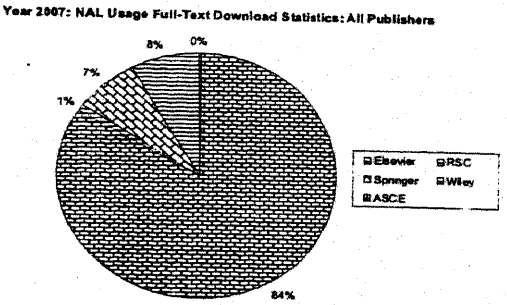


Figure – 6: Year 2007: NAL Usage Full-Text Download Statistics: All Publishers

- 84% of full-text downloads for the Year 2007 is from journals published by Elsevier
- 8% of full-text downloads are from the publisher Wiley
- 7% of full-text downloads are from publisher Springer
- Minimum percentage of full-text downloads are from the publisher RSC
- Download statistics for the following publishers, namely, ACS, AIP, ASME and CUP for the Year 2007 is not available.

Table – 4: Highlights the consolidated monthly total downloads, Publisher Wise for the Years 2005, 2006, 2007.

Consolidated statistics for ACS, AIP, ASME, CUP have not been tabulated for 2007 as data is not available.

Sl.No.	Name of the Publisher	2005	2006	2007
1.	ACS	204	128	-
2.	AIP	880	1620	-
3.	ASME	1037	1197	-
4.	CUP	184	214	-
5.	Elsevier	19067	27791	52779
6.	RSC	70	92	516
7.	Springer	943	1845	4615
8.	Wiley	1631	1956	4928
9.	ASCE	-	-	182
10.	OUP	-	149	-

- Chi-Square test was applied to test whether there is independence between the years and the publishers
- The calculated value of Chi-Square was found to be 510.6, which is highly significant.
- Hence we conclude that for the full-text downloads data the years and the publishers are not independent
- This Chi-Square test was carried out for only those publishers (4 in number) for which the data was available for all the three years (2005-2007).

Table – 5: Highlights the total number of downloads (Month Wise, All Publishers) for the Years 2005, 2006, 2007.

Sl.No.	Name of the Month	2005	2006	2007
1.	January	1561	3625	4729
2.	February	1339	3941	4128
3.	March	2752	2248	6529
4.	April	1449	2630	6013
5.	May	2218	3371	5608
6.	June	2387	2310	5249
7.	July	1497	2260	5322
8.	August	1631	1956	4928
9.	September	2165	2549	4895
10.	October	1420	2773	5586
11.	November	1987	3258	4438
12.	December	2661	3675	3980
Grand Total:		24016	35583	63020

- From this table it is observed that the mean number (per-month) of full-text downloads for the above three years was found to be different through Kruskal Wallis test of 'One Way Analysis of Variance' at 1% level of significance

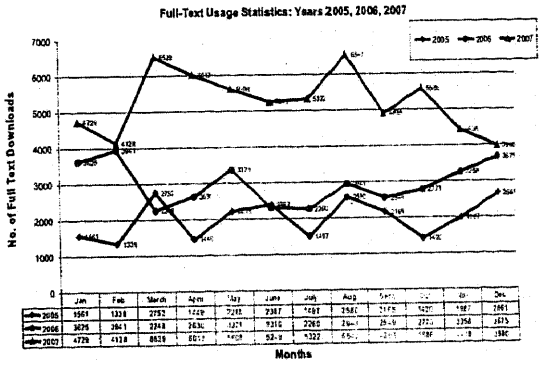


Figure – 7: Line Graph: Full-Text Usage Statistics: Years, 2005, 2006, 2007

- In 2005, full-text usage varied between 1561 in the month of January to 2661 in the month of December with a peak of 2580 in the month of August, 2005.
- In 2006, the number of full-text usage varied little with 3625 in the month of January to 3675 in the month of December with a peak of 3941 in the month of February, 2006.
- In 2007, the full-text download increased with 4729 in the month of January to a maximum of 6529 in the month of March and 6543 in the month of August and declined to a value of 3980 in the month of December 2007.

10. Conclusion

The coming of age of the electronic journals has altered the way scholarly information is disseminated throughout the world [22]. They have not only affected the way information is spread, but the way information is acquired and how scientific researchers seek that needed information.

We discuss a 'new methodology' [5] that has emerged for studying journal usage and scholarly information seeking behaviour, popularly called the "transaction log analysis". Other methodologies including 'Deep Log Analysis Method' [6,7,8] are also discussed.

In this paper, the authors present the analysis of data on the full-text e-journal patterns for the period 2005 to 2007. The major findings that we would like to highlight in this paper are:

(a) The mean number (per-month) of full-text downloads for the above three years was found to be different through Kruskal Wallis test of 'One Way Analysis of Variance' at 1% level of significance and

(b) Chi-Square test was applied to test whether there is independence between the years and the publishers. The calculated value of Chi-Square was found to be 510.6, which is highly significant. Hence we conclude that for the full-text downloads data, the years and the publishers are not independent. This Chi-Square test was carried out for only those publishers (4 in number) for which the data was available for all the three years (2005-2007).

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